



# Cybersecurity

## Module 11 Challenge Submission File

### Network Security Homework

Make a copy of this document to work in, and then fill out the solution for each prompt below. Save and submit this completed file as your Challenge deliverable.

#### Part 1: Review Questions

##### Security Control Types

The concept of defense in depth can be broken down into three security control types. Identify the security control type of each set of defense tactics.

1. Walls, bollards, fences, guard dogs, cameras, and lighting are what type of security control?

Physical

2. Security awareness programs, BYOD policies, and ethical hiring practices are what type of security control?

Administrative

3. Encryption, biometric fingerprint readers, firewalls, endpoint security, and intrusion detection systems are what type of security control?

Technical

## Intrusion Detection and Attack Indicators

### 1. What's the difference between an IDS and an IPS?

The difference between IDS and IPS is that an IDS only provides the alert that someone is attacking or there is something wrong, whereas an IPS will do the same but also acts and responds to the incident. IPS is inline.

### 2. What's the difference between an indicator of attack (IOA) and an indicator of compromise (IOC)?

The difference between IOA and IOC is, that IOA indicates when an attack is happening in real-time as well as revealing the intent and end goal of attacker, whereas IOC gathers evidence from the network that shows that it has been infiltrated as well as emerging threats, and exposed vulnerabilities that allow defenders opportunity to revamp and fix the vulnerability.

## The Cyber Kill Chain

Name the seven stages of the cyber kill chain, and provide a brief example of each.

### 1. Stage 1:

Reconnaissance:

Browsing the internet or social media to find a target to attack or which potential target has higher impact if attacked.

### 2. Stage 2:

Weaponization:

Preparing the payload/malicious code depending on the target system.

### 3. Stage 3:

Delivery:

Sending an email with the malware embedded and all the victim has to do is open it and download it

#### 4. Stage 4:

Exploitation:

After the email has been received and downloaded on the victim's computer it triggers the code

#### 5. Stage 5:

Installation:

The malicious code that was downloaded on the system is running on the victim's computer

#### 6. Stage 6:

Command and Control:

Depending on what the malicious code does, an attacker could have embedded a backdoor within the victim's system that allows them to takeover from their own computer

#### 7. Stage 7:

Actions on Objectives:

The attacker acts on and finds within the system what they are looking for.

## Snort Rule Analysis

Use the provided Snort rules to answer the following questions:

## Snort Rule #1

```
alert tcp $EXTERNAL_NET any -> $HOME_NET 5800:5820 (msg:"ET SCAN Potential VNC Scan 5800-5820"; flags:S,12; threshold: type both, track by_src, count 5, seconds 60; reference:url,doc.emergingthreats.net/2002910; classtype:attempted-recon; sid:2002910; rev:5; metadata:created_at 2010_07_30, updated_at 2010_07_30;)
```

1. Break down the Sort rule header and explain what this rule does.

Alert = alert action  
Tcp = any tcp packets  
\$EXTERNAL\_NET = any source ip coming from outside the network  
Any = coming from any port  
-> = coming into home network  
\$HOME\_NET = the destination is in our home network  
5800:5820 = coming on these port numbers

Alerts user if there are any intruders scanning for ip addresses on ports 5800-5820 that are connected to vnc servers that are configured without a password

2. What stage of the cyber kill chain does the alerted activity violate?

Reconnaissance

3. What kind of attack is indicated?

Attempted-recon : Potential VNC Scan 5800-5820

## Snort Rule #2

```
alert tcp $EXTERNAL_NET $HTTP_PORTS -> $HOME_NET any (msg:"ET POLICY PE EXE or DLL Windows file download HTTP"; flow:established,to_client; flowbits:isnotset,ET.http.binary; flowbits:isnotset,ET.INFO.WindowsUpdate; file_data; content:"MZ"; within:2; byte_jump:4,58,relative,little; content:"PE|00 00|"; distance:-64; within:4; flowbits:set,ET.http.binary; metadata: former_category POLICY;
```

```
reference:url,doc.emergingthreats.net/bin/view/Main/2018959;  
classtype:policy-violation; sid:2018959; rev:4; metadata:created_at  
2014_08_19, updated_at 2017_02_01;)
```

1. Break down the Snort rule header and explain what this rule does.

Alert = alert message  
Tcp = all tcp packets  
\$EXTERNAL\_NET = any network outside the home network  
\$HTTP\_PORTS = any http port ex: 80  
-> = coming into the home network  
\$HOME\_NET = Destination home network  
Any = any port on the home network

Alerts that someone has downloaded an executable file or DLL file over http

2. What layer of the defense in depth model does the alerted activity violate?

Application

3. What kind of attack is indicated?

Policy violation : ET POLICY PE EXE or DLL Windows file download HTTP

A DLL Windows file download or and executable file - possibly malware or information gathering from an http download

### Snort Rule #3

Your turn! Write a Snort rule that alerts when traffic is detected inbound on port 4444 to the local network on any port. Be sure to include the `msg` in the rule option.

```
Alert tcp $EXTERNAL_NET 4444 -> $HOME_NET any {msg: "tcp packet detected";}
```

## Part 2: "Drop Zone" Lab

## Set up.

Log in using the following credentials:

- Username: sysadmin
- Password: cybersecurity

## Uninstall UFW.

Before getting started, you should verify that you do not have any instances of UFW running. This will avoid conflicts with your firewalld service. This also ensures that firewalld will be your default firewall.

- Run the command that removes any running instance of UFW.

```
$ sudo apt remove ufw
```

## Enable and start firewalld.

By default, the firewalld service should be running. If not, then run the commands that enable and start firewalld upon boots and reboots.

```
$ sudo systemctl enable firewalld  
and  
$ sudo systemctl start firewalld
```

**Note:** This will ensure that firewalld remains active after each reboot.

## Confirm that the service is running.

Run the command that checks whether the firewalld service is up and running.

```
$ sudo firewall-cmd --state  
Or
```

```
$ service firewalld status
```

List all firewall rules currently configured.

Next, list all currently configured firewall rules. This will give you a good idea of what's currently configured and save you time in the long run by ensuring that you don't duplicate work that's already done.

- Run the command that lists all currently configured firewall rules:

```
$ firewall-cmd --list-all
```

- Take note of what zones and settings are configured. You may need to remove unneeded services and settings.

List all supported service types that can be enabled.

- Run the command that lists all currently supported services to find out whether the service you need is available.

```
$ sudo firewall-cmd --get-services
```

- Notice that the `home` and `drop` zones are created by default.

Zone views.

- Run the command that lists all currently configured zones.

```
$ sudo firewall-cmd --list-all-zones
```

- Notice that the `public` and `drop` zones are created by default. Therefore, you will need to create zones for `web`, `sales`, and `mail`.

## Create zones for web, sales, and mail.

- Run the commands that create web, sales, and mail zones.

```
$ sudo firewall-cmd --permanent --new-zone=web --add-source=201.45.34.126
$ sudo firewall-cmd --permanent --new-zone=sales --add-source=201.45.15.48
$ sudo firewall-cmd --permanent --new-zone=mail --add-source=201.45.105.12
```

## Set the zones to their designated interfaces.

- Run the commands that set your eth interfaces to your zones.

```
$ sudo firewall-cmd --zone=public --change-interface=eth0
$ sudo firewall-cmd --zone=web --change-interface=eth1
$ sudo firewall-cmd --zone=sales --change-interface=eth2
$ sudo firewall-cmd --zone=mail --change-interface=eth3
```

## Add services to the active zones.

- Run the commands that add services to the public zone, the web zone, the sales zone, and the mail zone.
- public:

```
$ sudo firewall-cmd --permanent --zone=public --add-service=http
$ sudo firewall-cmd --permanent --zone=public --add-service=https
$ sudo firewall-cmd --permanent --zone=public --add-service=pop3
$ sudo firewall-cmd --permanent --zone=public --add-service=smtp
```

- web:

```
$ sudo firewall-cmd --permanent --zone=web --add-service=http
```

- sales:



```
$ sudo firewall-cmd --permanent --zone=sales --add-service=https
```

- mail:

```
$ sudo firewall-cmd --permanent --zone=mail --add-service=smtp  
$ sudo firewall-cmd --permanent --zone=mail --add-service=pop3
```

- What is the status of http, https, smtp and pop3?

```
Sudo firewall-cmd --list-services
```

Add your adversaries to the drop zone.

- Run the command that will add all current and any future blacklisted IPs to the drop zone.

```
$ sudo firewall-cmd --permanent --new-zone=drop --add-source=10.208.56.23  
$ sudo firewall-cmd --permanent --new-zone=drop --add-source=135.95.103.76  
$ sudo firewall-cmd --permanent --new-zone=drop --add-source=76.34.169.118  
$ <ADD COMMAND HERE>
```

Make rules permanent, then reload them.

It's good practice to ensure that your firewalld installation remains nailed up and retains its services across reboots. This helps ensure that the network remains secure after unplanned outages such as power failures.

- Run the command that reloads the firewalld configurations and writes it to memory:

```
$ sudo firewall-cmd --reload
```

View active zones.

Now, provide truncated listings of all currently **active** zones. This is a good time to verify your zone settings.

- Run the command that displays all zone services.

```
$ sudo firewall-cmd --get-active-zones
```



```
sysadmin@firewalld-host:~$ sudo firewall-cmd --get-active-zones
drop
  sources: 10.208.56.23 135.95.103.76 76.34.169.118
mail
  interfaces: eth3
  sources: 201.45.105.12
public
  interfaces: eth0
sales
  interfaces: eth2
  sources: 201.45.15.48
web
  interfaces: eth1
  sources: 201.45.34.126
sysadmin@firewalld-host:~$
```

Block an IP address.

- Use a rich-rule that blocks the IP address 138.138.0.3 on your public zone.

```
$ sudo firewall-cmd --zone=public --add-rich-rule='rule family="ipv4" source
address="138.138.0.3" reject'
```

Block ping/ICMP requests.

Harden your network against ping scans by blocking icmp ehco replies.

- Run the command that blocks pings and icmp requests in your public zone.

```
$ sudo firewall-cmd --zone=public --add-icmp-block=echo-reply
--add-icmp-block=echo-request
```

### Rule check.

Now that you've set up your brand new firewalld installation, it's time to verify that all of the settings have taken effect.

- Run the command that lists all of the rule settings. Do one command at a time for each zone.

```
$ sudo firewall-cmd --zone=public --list-all
```

```
sysadmin@firewalld-host:~$ sudo firewall-cmd --zone=public --list-all
public (active)
  target: default
  icmp-block-inversion: no
  interfaces: eth0
  sources:
  services: ssh dhcpv6-client http https pop3 smtp
  ports:
  protocols:
  masquerade: no
  forward-ports:
  source-ports:
  icmp-blocks: echo-reply echo-request
  rich rules:
    rule family="ipv4" source address="138.138.0.3" reject
sysadmin@firewalld-host:~$
```

```
$ sudo firewall-cmd --zone=web --list-all
```

```
sysadmin@firewalld-host:~$ sudo firewall-cmd --zone=web --list-all
web (active)
  target: default
  icmp-block-inversion: no
  interfaces: eth1
  sources: 201.45.34.126
  services: http
  ports:
  protocols:
  masquerade: no
  forward-ports:
  source-ports:
  icmp-blocks:
  rich rules:

sysadmin@firewalld-host:~$
```

```
$ sudo firewall-cmd --zone=sales --list-all
```

```
sysadmin@firewalld-host:~$ sudo firewall-cmd --zone=sales --list-all
sales (active)
  target: default
  icmp-block-inversion: no
  interfaces: eth2
  sources: 201.45.15.48
  services: https
  ports:
  protocols:
  masquerade: no
  forward-ports:
  source-ports:
  icmp-blocks:
  rich rules:

sysadmin@firewalld-host:~$
```

```
$ sudo firewall-cmd --zone=mail --list-all
```

```
sysadmin@firewalld-host:~$ sudo firewall-cmd --zone=mail --list-all
mail (active)
  target: default
  icmp-block-inversion: no
  interfaces: eth3
  sources: 201.45.105.12
  services: smtp pop3
  ports:
  protocols:
  masquerade: no
  forward-ports:
  source-ports:
  icmp-blocks:
  rich rules:

sysadmin@firewalld-host:~$
```

```
$ sudo firewall-cmd --zone=drop --list-all
```

```
sysadmin@firewalld-host:~$ sudo firewall-cmd --zone=drop --list-all
drop (active)
  target: DROP
  icmp-block-inversion: no
  interfaces:
  sources: 10.208.56.23 135.95.103.76 76.34.169.118
  services:
  ports:
  protocols:
  masquerade: no
  forward-ports:
  source-ports:
  icmp-blocks:
  rich rules:

sysadmin@firewalld-host:~$
```

- Are all of the rules in place? If not, then go back and make the necessary modifications before checking again.

Congratulations! You have successfully configured and deployed a fully comprehensive firewalld installation.

## Part 3: IDS, IPS, DiD and Firewalls

Now, you'll work on another lab. Before you start, complete the following review questions.

### IDS vs. IPS Systems

1. Name and define two ways an IDS connects to a network.

NIDS - Network Intrusion Detection System = it monitors and matches all incoming traffic to a known library of attack signatures and compares them, as well as it passively examines the network

HIDS - Host Based Detection System = it examines the entire file system on the host computer and compares them to the previous snapshots and generates an alert if something is different between the two.

2. Describe how an IPS connects to a network.

An IPS is inline in a network, it is put in between the firewall and switch to act as a second line of defense.

3. What type of IDS compares patterns of traffic to predefined signatures and is unable to detect zero-day attacks?

Signature-based IDS

4. What type of IDS is beneficial for detecting all suspicious traffic that deviates from the well-known baseline and is excellent at detecting when an attacker probes or sweeps a network?

Anomaly-based IDS

### Defense in Depth

1. For each of the following scenarios, provide the layer of defense in depth that applies:

- a. A criminal hacker tailgates an employee through an exterior door into a secured facility, explaining that they forgot their badge at home.

Physical

- b. A zero-day goes undetected by antivirus software.

Application

- c. A criminal successfully gains access to HR's database.

Host

- d. A criminal hacker exploits a vulnerability within an operating system.

Data

- e. A hacktivist organization successfully performs a DDoS attack, taking down a government website.

Network

- f. Data is classified at the wrong classification level.

Application

- g. A state-sponsored hacker group successfully firewalked an organization to produce a list of active services on an email server.

Perimeter

2. Name one method of protecting data-at-rest from being readable on hard drive.

Encrypting the hard drive

3. Name one method of protecting data-in-transit.

Encryption, VPN

4. What technology could provide law enforcement with the ability to track and recover a stolen laptop?

Gps tags or trackers

5. How could you prevent an attacker from booting a stolen laptop using an external hard drive?

Encrypted password

## Firewall Architectures and Methodologies

1. Which type of firewall verifies the three-way TCP handshake? TCP handshake checks are designed to ensure that session packets are from legitimate sources.

Circuit-level gateway

2. Which type of firewall considers the connection as a whole? Meaning, instead of considering only individual packets, these firewalls consider whole streams of packets at one time.

Stateful packet filtering

3. Which type of firewall intercepts all traffic prior to forwarding it to its final destination? In a sense, these firewalls act on behalf of the recipient by ensuring the traffic is safe prior to forwarding it.

Application/Proxy gateway



4. Which type of firewall examines data within a packet as it progresses through a network interface by examining source and destination IP address, port number, and packet type—all without opening the packet to inspect its contents?

Packet-Filtering

5. Which type of firewall filters solely based on source and destination MAC address?

MAC

## Bonus Lab: “Green Eggs & SPAM”

In this activity, you will target spam, uncover its whereabouts, and attempt to discover the intent of the attacker.

- You will assume the role of a junior security administrator working for the Department of Technology for the State of California.
- As a junior administrator, your primary role is to perform the initial triage of alert data: the initial investigation and analysis followed by an escalation of high-priority alerts to senior incident handlers for further review.
- You will work as part of a Computer and Incident Response Team (CIRT), responsible for compiling **threat intelligence** as part of your incident report.

### Threat Intelligence Card

**Note:** Log in to the Security Onion VM, and use the following **indicator of attack** to complete this portion of the assignment.

Locate the indicator of attack in Sguil based off of the following:

- **Source IP/port:** 188.124.9.56:80
- **Destination address/port:** 192.168.3.35:1035
- **Event message:** ET TROJAN JS/Nemucod.M.gen downloading EXE payload

Answer the following questions:

1. What was the indicator of an attack? (*Hint: What do the details reveal?*)

Trojan attack and the payload is being downloaded by your computer

2. What was the adversarial motivation (purpose of the attack)?

To inject a piece of malicious code

3. Describe observations and indicators that may be related to the perpetrators of the intrusion. Categorize your insights according to the appropriate stage of the cyber kill chain, as structured in the following table:

TTP	Example	Findings
Reconnaissance	How did the attacker locate the victim?	
Weaponization	What was downloaded?	
Delivery	How was it downloaded?	Internet downloaded
Exploitation	What does the exploit do?	
Installation	How is the exploit installed?	
Command & Control (C2)	How does the attacker gain control of the remote machine?	
Actions on Objectives	What does the software that the attacker sent do to complete its tasks?	

4. What are your recommended mitigation strategies?

[Enter answer here]

5. List your third-party references.

[Enter answer here]